# General Mathematics Preliminary & HSC Course Outline

# This book belongs to:

_____

# Information for Students

This booklet is an important document. It explains the outcomes of the course you are studying and is a valuable resource for when you are studying. The performance bands included explain to you what you need to do to demonstrate your knowledge, understanding and skills.

If you miss lessons **it is your responsibility** to find out if any information about assessment tasks was given out during the period of absence in addition to catching up on any missed work. In cases of prolonged absence you should request that school work be sent home for you to complete.

If you don't understand what is required of you in any assessment task **it is your responsibility** to seek help from your class teacher or the Head Teacher.

You will need to attend each lesson and complete all class work. The Board of Studies may refuse to grant a Higher School Certificate to a student whose attendance or application to work has been unsatisfactory.

**It is your responsibility to carefully read and understand this information and ask for any clarification if you do not understand.**

# Contents

# A Glossary of Key Words

Syllabus outcomes, objectives, performance bands and examination questions have key works that state what students are expected to be able to do. A glossary of key words has been developed to help provide a common language and consistent meaning in the Higher School Certificate documents.

| | |
|---|---|
| Account | Account for: state reasons for, report on. Give an account of: narrate a series of events or transactions |
| Analyse | Identify components and the relationship between them; draw out and relate implications |
| Apply | Use, utilise, employ in a particular situation |
| Appreciate | Make a judgment about the value of |
| Assess | Make a judgment of value, quality, outcomes, results or size |
| Calculate | Ascertain/determine from given facts, figures or information |
| Clarify | Make clear or plain |
| Classify | Arrange or include in classes/categories |
| Compare | Show how things are similar or different |
| Construct | Make: build; put together items or arguments |
| Contrast | Show how things are different or opposite |
| Critically (analyze/evaluate) | Add a degree or level of accuracy, depth, knowledge understanding, logic, questioning, reflection and quality to (analysis/evaluation) |
| Deduce | Draw conclusions |
| Define | State meaning and identify essential qualities |
| Demonstrate | Show by example |
| Describe | Provide characteristics and features |
| Discuss | Identify issues and provide points for and/or against |
| Distinguish | Recognise or note/indicate as being distinct or different from; to note differences between |
| Evaluate | Make a judgment based on criteria; determine the value of |
| Examine | Inquire into |
| Explain | Relate cause and effect; make the relationships between things evident; provide why and/or how |
| Extract | Choose relevant and/or appropriate details |
| Extrapolate | Infer from what is known |
| Identify | Recognise and name |
| Interpret | Draw meaning from |
| Investigate | Plan, inquire into and draw conclusions about |
| Justify | Support an argument or conclusion |
| Outline | Sketch in general terms; indicate the main features of |
| Predict | Suggest what may happen based on available information |
| Propose | Put forward (for example a point of view, idea, argument, suggestion) for consideration or action |
| Recall | Present remembered ideas, facts or experiences |
| Recommend | Provide reasons in favour |
| Recount | Retell a series of events |
| Summarise | Express, concisely, the relevant details |
| Synthesise | Putting together various elements to make a whole |

# Marking Criteria

At the completion of your HSC course you will receive a Certificate of Achievement that indicates your level of achievement in each of your courses. Your final mark for each subject will place you in one of 6 bands (similar to your School Certificate), 6 being the highest and 2 being the lowest with only the minimum standard being achieved. Band 1 will be below the minimum standard needed to successfully complete the course.

To achieve a result in Bands 5 or 6 you need to consistently present solutions as described in the "Best Solutions" below. To achieve a result in bands 3 or 4 you need to consistently present solutions as described in the "Average Solutions" below. Presented solutions as described in the "Minimum Standard Solutions" below may give you a result in Band 2.

Your final mark is an average of your school assessment and your HSC examination mark. By the time you have completed the Preliminary Course you should have developed sufficient knowledge, skills and work habits to be able to consistently set out your solutions as described in "The Best Solutions" section below. As the school assessment is continuous throughout the HSC you will need to apply these points to all your work for the HSC course.

***The Best Solutions should:***

- Use a wide variety of problem solving strategies, successfully applying mathematical skills and processes to the most appropriate method.
- Clearly show understanding of the questions intent.
- Correctly use the language of mathematics including symbols, abbreviations, notation and conventions.
- Use graphs and diagrams to show understanding of the problem and as an aid in finding the solution.
- Demonstrate a good understanding of all the mathematical concepts involved.
- Recognise and fully explain each step involved in the solution in a clear logical sequence.
- Draw diagrams and graphs that are clearly labelled, reasonably sized and well executed using correct geometrical instruments (ruler, set square, pair of compasses).
- Give answers that are mathematically correct, expressed in the simplest form and with the correct units.
- State any formula used, clearly show the substitution and then evaluate.

- Clearly show the final answer, including writing the answer in a sentence when appropriate.
- Avoid using rounded values during the course of calculations and write down the full calculator answer before giving a rounded off answer.
- Leave incorrect and rough working still legible by only using a single line to cross out unwanted working in a solution.
- Show working spread out neatly, working down the page, not across, avoid using columns, ensure numbered parts are clearly indicated.
- Avoid irrelevant algebra and number crunching, or proving given information or giving essay answers when a sentence (or two) is enough.

***The Average Solution should:***

- Use a variety of problem solving strategies, applying mathematical skills and processes to the method used with only minor errors.
- Clearly show understanding of the questions intent.
- Correctly use the language of mathematics including symbols, abbreviations, notation and conventions in most parts of the solution.
- Use graphs and diagrams to show understanding of the problem and as an aid in finding the solution.
- Generally demonstrate understanding of the mathematical concepts involved.
- Explain each step involved in the solution in a clear logical sequence.
- Draw diagrams and graphs that are clearly labelled, reasonably sized and well executed using correct geometrical instruments (ruler, set square, pair of compasses).
- Generally give answers that are mathematically correct, expressed in the simplest form and with the correct units.
- State any formula used, clearly show the substitution and then evaluate.
- Clearly show the final answer, including writing the answer in a sentence when appropriate.
- Avoid using rounded values during the course of calculations and write down the full calculator answer before giving a rounded off answer.
- Leave incorrect and rough working still legible, using only a single line to cross out unwanted working in a solution.
- Show working spread out neatly, working down the page, not across, avoid using columns, ensure numbered parts are clearly indicated.
- Generally avoid irrelevant algebra and number crunching, or proving given information or giving essay answers when a sentence (or two) is enough.

***The Minimum Standard Solutions should:***

- Apply mathematical skills and processes to the method used with only minor errors.
- Correctly use some of the language of mathematics including symbols, abbreviations, notation and conventions.
- Use graphs and diagrams as an aid in finding the solution.
- Demonstrate some understanding of the mathematical concepts involved.
- Explain steps involved in the solution.
- Draw diagrams and graphs that are clearly labelled, reasonably sized and well executed using correct geometrical instruments (ruler, set square, pair of compasses).
- Generally give answers that are mathematically correct with correct units.
- State any formula used, clearly show the substitution and then evaluate.
- Clearly show the final answer, including writing the answer in a sentence when appropriate.
- Avoid using rounded values during the course of calculations and write down the full calculator answer before giving a rounded off answer.
- Leave incorrect and rough working still legible, using a single line to cross out unwanted working in a solution.
- Show working spread out neatly, working down the page, not across, avoid using columns, ensure numbered parts are clearly indicated.

# Aim

General Mathematics is designed to promote the development of skills, knowledge and understanding in areas of mathematics that have direct application to the broad range of human activity. Students will learn to use a range of techniques and tools to develop solutions to a wide variety of problems related to their present and future needs and aspirations.

# Objectives

Students will develop:

- appreciation of the relevance of mathematics
- the ability to apply mathematical skills and techniques to interpret practical situations
- the ability to communicate mathematics in written and/or verbal form
- skills, knowledge and understanding in financial mathematics
- skills, knowledge and understanding in data analysis
- skills, knowledge and understanding in measurement
- skills, knowledge and understanding in probability
- skills, knowledge and understanding in algebraic modeling.

# Course Structure

The following schematic view provides an overview of the arrangement and relationship between components of the Preliminary course and HSC course for General Mathematics Stage 6.

| Preliminary Course | HSC Course |
|---|---|
| Financial Mathematics<br>€ FM1: Earning money<br>€ FM2: Investing money<br>€ FM3: Taxation | Financial Mathematics<br>€ FM4: Credit and borrowing<br>€ FM5: Annuities and loan repayments<br>€ FM6: Depreciation |
| Data Analysis<br>€ DA1: Statistics and society<br>€ DA2: Data collection and sampling<br>€ DA3: Displaying single data sets<br>€ DA4: Summary statistics | Data Analysis<br>€ DA5: Interpreting sets of data<br>€ DA6: The normal distribution<br>€ DA7: Correlation |
| Measurement<br>€ M1: Units of measurement<br>€ M2: Applications of area and volume<br>€ M3: Similarity of two-dimensional figures<br>€ M4: Right-angled triangles | Measurement<br>€ M5: Further applications of area and volume<br>€ M6: Applications of trigonometry<br>€ M7: Spherical geometry |
| Probability<br>€ PB1: The language of chance<br>€ PB2: Relative frequency and probability | Probability<br>€ PB3: Multi-stage events<br>€ PB4: Applications of probability |
| Algebraic Modelling<br>€ AM1: Basic algebraic skills<br>€ AM2: Modelling linear relationships | Algebraic Modelling<br>€ AM3: Algebraic skills and techniques<br>€ AM4: Modelling linear and non-linear relationships |

# Objectives and Outcomes

| Objectives | Preliminary Outcomes | HSC Outcomes |
|---|---|---|
| Students will develop: | A student: | A student: |
| appreciation of the relevance of mathematics | P1<br>develops a positive attitude to mathematics and appreciates its capacity to provide enjoyment and recreation | H1<br>appreciates the importance of mathematics in her/his own life and its usefulness in contributing to society |
| the ability to apply mathematical skills and techniques to interpret practical situations | P2<br>applies mathematical knowledge and skills to solving problems within familiar contexts | H2<br>integrates mathematical knowledge and skills from different content areas in exploring new situations |
| | P3<br>develops rules to represent patterns arising from numerical and other sources | H3<br>develops and tests a general mathematical relationship from observed patterns |
| skills, knowledge and understanding in algebraic modelling | P4<br>represents information in symbolic, graphical and tabular forms | H4<br>analyses representations of data in order to make inferences, predictions and conclusions |
| | P5<br>represents the relationships between changing quantities in algebraic and graphical form | H5<br>makes predictions about the behaviour of situations based on simple models |
| skills, knowledge and understanding in measurement | P6<br>performs calculations in relation to two-dimensional and three-dimensional figures | H6<br>analyses two-dimensional and three-dimensional models to solve practical and mathematical problems |
| | P7<br>determines the degree of accuracy of measurements and calculations | H7<br>interprets the results of measurements and calculations and makes judgements about reasonableness |

| Objectives | Preliminary Outcomes | HSC Outcomes |
|---|---|---|
| Students will develop: | A student: | A student: |
| skills, knowledge and understanding in financial mathematics | P8<br>models financial situations using appropriate tools | H8<br>makes informed decisions about financial situations |
| skills, knowledge and understanding in data analysis | P9<br>determines an appropriate form of organisation and representation of collected data | H9<br>develops and carries out statistical processes to answer questions which she/he and others have posed |
| skills, knowledge and understanding in probability | P10<br>performs simple calculations in relation to the likelihood of familiar events | H10<br>solves problems involving uncertainty using basic principles of probability |
| the ability to communicate mathematics in written and/or verbal form | P11<br>justifies his/her response to a given problem using appropriate mathematical terminology | H11<br>uses mathematical argument and reasoning to evaluate conclusions drawn from other sources, communicating his/her position clearly to others |

## The use of formulae in the teaching and assessment of the course

Any formulae that have been required in the Mathematics Stage 4 (Years 7–8) Syllabus are considered to be assumed knowledge. These include formulae for:

- € calculations involving the theorem of Pythagoras
- € perimeter
- € the circumference of a circle
- € the area of a rectangle, triangle and circle.

Formulae required in the themes of the Stage 5 Standard course are considered to be assumed knowledge. These include formulae for the:

- € area of a parallelogram, trapezium and rhombus
- € volume of a right prism.

Students are not required to learn other formulae that are introduced or referred to in this syllabus. A list of formulae will be provided with the HSC examination.

# PRELIMINARY COURSE
# Financial Mathematics

FM1: Earning money

- € calculation of monthly, fortnightly, weekly, daily and hourly payments from salary
- € calculation of wages incorporating hourly rate, penalty rates such as overtime, special allowances for, for example, wet work, confined spaces, toxic substances, heat, heights
- € calculation of annual leave loading
- € calculation of earnings based on commission, piecework, royalties
- € calculation of income based on government allowances, such as youth allowance, pensions
- € determination of deductions such as union fees, superannuation contributions, health fund installments and tax installments
- € calculation and comparison of user costs associated with maintaining accounts with financial institutions
- € calculation of net pay following deductions
- € creation and management of budgets
- € reading information from household bills, including those for electricity, gas, telephone, council rates and water rates.

FM2: Investing money

- € calculation of simple interest using $I = \Pr n$, where P = principal, r = percentage interest rate per period expressed as a decimal (eg if the rate is quoted as 8.2%, then r = 0.082), and n = number of periods for fixed values of P, using tables of values and hence drawing and describing graphs of I against n for differing values of r. Note: these are linear graphs whose gradient is determined by the value of r (see AM2, AM4)
- € calculation of monthly, quarterly, six-monthly interest rates based on quoted rates per annum (pa)
- € use of formulae to calculate future value, compound interest and present value with pen and paper $A = P(1+r)^n$, where A (amount) = final balance (future value), P (principal) = initial quantity (present value), n = number of compounding periods, r = interest rate per compounding period. Note: In the financial world, the compound interest formula quoted above is generally presented as $FV = PV(1+r)^n$, where FV = future value and PV = present value
- € for fixed values of P, using tables of values and hence drawing and describing graphs of A against n for differing values of r. Note: these are examples of exponential growth (see AM3, AM4)
- € calculation of dividend paid on a share holding and the dividend yield, excluding franked dividends
- € extrapolating from the information shown on a prepared graph of share performance to suggest possible future movement
- € calculating future and present value of an investment from prepared tables
- € calculation of the price of goods following inflation
- € calculating the appreciated value of items such as stamp collections, memorabilia.

FM3: Taxation

- € calculation of the amount of allowable deductions from gross income
- € calculation of taxable income
- € calculation of Medicare levy (basic levy only — see Tax Pack for details)
- € calculation of PAYE (Pay As You Earn) tax payable or refund owing, using current tax scales
- € given rates of tax from a range of countries, calculation of the Value Added Tax (VAT) payable on a range of goods and services
- € calculation of the goods and services tax (GST) payable on a range of goods and services
- € creating graphs to illustrate and describe different tax rates

# Data Analysis

DA1: Statistics and society

- € the importance of analysing data in planning and decision-making by governments and businesses
- € the process of statistical inquiry, including the following steps:
  - posing questions
  - collecting data
  - organising data
  - summarising and displaying data
  - analysing data and drawing conclusions
  - writing a report
- € the role of statistical methods in quality control in manufacturing industries
- € issues of privacy and ethics in data collection and analysis
- € organisations that collect and/or use statistics, including the Australian Bureau of Statistics (ABS), the United Nations (UN), the World Health Organisation (WHO).

DA2: Data collection and sampling

- € identification of the target population to be investigated
- € determining whether data for the whole population is available or whether sampling is necessary
- € recognising that the purpose of a sample is to provide an estimate for a particular population characteristic when the entire population cannot be accessed
- € classification of data as:
  - Quantitative, either discrete or continuous
  - Categorical
- € distinguishing between the following sample types:

- random
- stratified
- systematic

€ determination of which of the above sample types is appropriate for a given situation
€ relating sample selection to population characteristics,
€ generating random numbers with a table or a calculator to assist in establishing random samples
€ describing and using the 'capture-recapture' technique for estimating the size of populations
€ recognising the effect of sample size in estimating the nature of the population
€ use of the principles for effective questionnaire design, such as
- simple language
- unambiguous questions
- respect for privacy
- freedom from bias
- consideration of number of choices

DA3: Displaying single data sets

€ creation of tally charts and frequency tables to organise ungrouped and grouped data
€ creation of dot plots, sector graphs (pie charts), bar graphs, histograms and line graphs, with attention being paid to the scale on each axis
€ selection of a suitable scale for each axis of a graph
€ noting the capacity of statistical displays for misrepresentation, particularly in the selection of the scale used on the axes
€ creation of a stem-and-leaf plot to illustrate a small data set
€ drawing a radar chart to display data
€ division of data into deciles and quartiles
€ determination of the range and interquartile range as measures of the spread of a data set
€ creation of frequency graphs and cumulative frequency graphs (ogives)
€ determining the median and upper and lower quartiles of a data set from a cumulative frequency polygon
€ establishment of a five number summary for a data set (lower extreme, lower quartile, median, upper quartile, upper extreme)
€ development of a box-and-whisker plot from a five number summary
€ linking types of data with appropriate displays, describing the strengths and/or weaknesses of sector graphs, bar graphs, histograms, frequency polygons and radar charts, including suitability for data represented.

DA4: Summary statistics

€ calculation of the mean of small data sets, using the formulae $\bar{x} = \frac{\sum x}{n}$, $\bar{x} = \frac{\sum fx}{\sum f}$ where $\bar{x}$, represents the mean of the sample
€ determination of the mean for larger data sets of either grouped and ungrouped data using the statistical functions of a calculator
€ calculation of the means of a range of samples from a population
€ informal description of standard deviation as a measure of the spread of data in relation to the mean
€ determination of the population standard deviation using the $\sigma_n$ button of a calculator and the sample standard deviation as an estimate of the population measure, using the $\sigma_{n-1}$ button
€ determination of the median and mode(s) of a data set, either from a list or from a frequency table
€ selection and use of the appropriate statistic (mean, median or mode) to describe features of a data set, eg median house prices, modal shirt size
€ comparison of the summary statistics of various samples from the same population.

# Measurement

M1: Units of measurement

€ determination of appropriate units to use when measuring physical attributes
€ conversion between commonly used units of measurement using standard prefixes
€ recognition that accuracy of physical measurement is limited to $\pm\frac{1}{2}$ of the smallest unit of which the measuring instrument is capable
€ calculation of the percentage error in a measurement
€ determination of possible sources of error in measuring
€ repeating and averaging measurements to reduce likelihood of error
€ determination of the significant figures to be used in recording measurements, in relation to the accuracy of the measuring instrument being used
€ use of positive and negative powers of ten in expressing numbers in scientific notation
€ calculation of rates eg pay rates, speeds, rates of flow
€ conversion between units for rates, eg km/h to m/s
€ calculation of concentrations expressed as weight/weight, weight/volume or volume/volume
€ determination of overall change in a quantity following repeated percentage changes,
€ finding the ratio of two quantities in familiar contexts
€ division of quantities in a given ratio
€ use of unitary method to solve problems.

M2: Applications of area and volume

- € calculation of the area of triangles and quadrilaterals (review only)
- € using a field diagram to calculate the area of irregularly shaped blocks of land
- € classifying polyhedra into prisms, pyramids or other
- € construction of nets of solids and matching nets to solids
- € sketching 3D solids using isometric paper and vanishing points
- € using appropriate formulae in calculating surface area of right prisms, square and rectangular pyramids
- € using appropriate formulae in calculating volume of right prisms, cylinders, pyramids, cones, spheres
- € application of the relationship between units of capacity and units of volume.

M3: Similarity of two-dimensional figures

- € establishment of properties of similar figures
- € recognition of similarity in everyday life
- € finding scale factors of similar figures
- € recognising that similar figures related by a scale factor of 1 are said to be congruent
- € use of the relevant enlargement or reduction factor to calculate actual dimensions
- € development of scale drawings of objects and images
- € use of scale factor to solve problems involving similar figures
- € transferring measurements between floor plans and elevations
- € obtaining measurements from plans of buildings and rooms
- € calculation of lengths and areas from a floor plan
- € interpretation of commonly used symbols on house plans.

M4: Right-angled triangles

- € use of Pythagoras' theorem to find an unknown side in a right-angled triangle
- € application of Pythagoras' theorem to:
  - determine whether or not a triangle is right-angled
  - solve problems based on single right-angled triangles
  - calculate perimeters of irregularly shaped blocks of land
- € defining sine, cosine and tangent ratios
- € use of trigonometric ratios to find the length of an unknown side in a right-angled triangle
- € use of trigonometric ratios to find the size of an unknown angle in a right-angled triangle using a calculator to approximate the angle to the nearest minute
- € solution of problems involving angles of elevation and depression, given the appropriate diagram
- € determining whether an answer seems reasonable by using a diagram drawn roughly in proportion.

# Probability

PB1: The language of chance

- € ordering everyday events from the very unlikely to the almost certain
- € using a list or table to identify the sample space (set of all possible outcomes) of a simple experiment or game
- € performing experiments and determining whether or not the outcomes are equally likely
- € determining the number of outcomes for a multi-stage event by multiplying the number of choices at each stage
- € using systematic lists to verify total number of outcomes for simple multi-stage events.

PB2: Relative frequency and probability

- € estimating the relative frequencies of events from recorded data
- € performing simple experiments to obtain relative frequencies from recorded results
- € using relative frequencies to obtain approximate probabilities
- € using the following definition of the probability of an event where outcomes are equally likely:

$$P(event) = \frac{number\ of\ favourable\ outcomes}{total\ number\ of\ outcomes}$$

- € calculating probabilities in terms of the fractional, decimal, or percentage chance
- € demonstrating the range of possible probabilities, $O \le P(E) \le 1$, through examination of a variety of results
- € comparing calculated probabilities with experimental results
- € illustrating the results of experiments through statistical graphs and displays (see DA3)
- € defining and using the relationship between complementary events

$$P(an\ event\ does\ not\ occur) = 1 - P(the\ event\ does\ occur)$$

# Algebraic Modelling

AM1: Basic algebraic skills

- € identification and generalisation of simple linear number patterns
- € adding and subtracting like terms
- € evaluation of the subject of a formula through substitution of numerical values, using a wide variety of formulae
- € solution of linear equations involving up to 3 steps (fractions with numerical denominators only)
- € expansion and simplification of expressions
- € multiplication of algebraic terms
- € division of single terms (linear, quadratic and cubic)
- € solving equations following substitution and evaluation,

AM2: Modelling linear relationships

- € sketching graphical representations of quantities that vary over a period of time or in relation to each other
- € identifying independent and dependent variables in practical contexts
- € graphing of linear functions derived from everyday situations
- € calculating the gradients of such graphs with ruler and pencil
- € establishing a meaning for the gradient in the given context
- € establishing a meaning for the intercept on the vertical axis in the given context
- € sketching graphs of linear functions expressed in the form $y = mx + b$
- € development of a linear graph of the form $y = ax$ from a description of a situation in which one quantity varies in a direct linear fashion with another, given one ordered pair
- € using the above graph to establish the value of a (the gradient) and to solve problems related to the given variation context
- € interpreting linear functions as models of physical phenomena
- € using stepwise and piecewise linear functions to model situations encountered in daily life
- € recognising the limitations of such models
- € using graphs to make conversions from one measurement to another
- € interpreting the graphical solution of simultaneous linear equations drawn from practical situations
- € drawing a line of best fit on a graphed set of ordered pairs with a ruler and pencil.

# HSC COURSE

# Financial Mathematics

FM4: Credit and borrowing

- € calculation of principal, interest and repayments for flat-rate loans
- € calculation of values in a table of home loan repayments
- € comparison of different options for borrowing money in relation to total repayments, fees, interest rates and flexibility
- € calculation of credit-card payments, incorporating fees, charges, rates and interest-free periods
- € use of published tables from financial institutions to determine monthly repayments on a reducing balance loan.

FM5: Annuities and loan repayments

- € recognition that an annuity is a form of investment involving periodical, equal contributions to an account, with interest compounding at the conclusion of each period
- € calculation of the future value (A) of an annuity (or the contribution per period), using

$$A = M\left\{\frac{(1+r)^n - 1}{r}\right\}$$

where M = contribution per period, paid at the end of the period.

- € calculation of the present value (N) of an annuity (or the contribution per period), using

$$N = M\left\{\frac{(1+r)^n - 1}{r(1+r)^n}\right\} or\ N = \frac{A}{(1+r)^n}$$

- € using tables to solve problems involving annuities
- € use the present value formula for annuities to calculate loan instalments, and hence the total amount paid over the term of a loan
- € investigate various processes for repayment of loans
- € calculate the fees and charges which apply to different options for borrowing money in order to make a purchase.

FM6: Depreciation

- € modelling depreciation by using appropriate graphs, tables and functions
- € using formulae for depreciation:
- € the straight line method $S = V_0 - Dn$, where s = salvage (current) value of asset, D = amount of depreciation apportioned per period, V0 = purchase price of the asset, and n = total number of periods
- € the declining balance method $S = V_0(1-r)^n$, where S is the salvage value after n periods, V0 is the

purchase price of the asset and r is the percentage interest rate per period, expressed as a decimal

- € preparing tables of values and hence developing graphs of against n for different values of r
- € comparing the results obtained through each method
- € using the above formulae to create and compare depreciation tables
- € calculating tax deductions based on depreciation of assets.

# Data Analysis

DA5: Interpreting sets of data

- € İdentifying measures of location as mean and median
- € identifying measures of spread as range, interquartile range and standard deviation
- € investigating outliers in small data sets and their effects on the mean, median and mode
- € describing the general shape of a graph or display which represents a given data set
- € making judgements about the data based on observed features of the display such as shape and skewness
- € displaying data in double (back-to-back) stem-and-leaf plots
- € displaying data in two box-and-whisker plots drawn on the same scale
- € displaying two sets of data on a radar chart
- € preparing an area chart to illustrate and compare different sets of data over time
- € using multiple displays to describe and interpret the relationships between data sets
- € interpreting data presented in two-way table form
- € comparing summary statistics from two sets of data.

DA6: The normal distribution

- € describing the z-score (standardised score) corresponding to a particular score in a set of scores as a number indicating the position of that score relative to the mean
- € using the formula $z = \frac{x - \bar{x}}{s}$ to calculate z-scores, where s is the standard deviation

  ( $s = \sigma_n$ for a population, $s = \sigma_{n-1}$ for a sample)
- € using calculated z-scores to compare scores from different data sets
- € identifying the properties of data that are normally distributed, ie the mean, median and mode are equal
- € if represented by a histogram, the resulting frequency graph is 'bell shaped'
- € using collected data to illustrate that, for normally distributed data:
  - approximately 68% of scores will have z-scores between –1 and 1
  - approximately 95% of scores will have z-scores between –2 and 2
  - of scores will have z-scores between –3 and 3
- € using these measures to make judgements in individual cases.

DA7: Correlation

- € plotting ordered pairs of data onto a scatterplot
- € recognising from the scatterplot:
- € whether the points appear to form a mathematical pattern
- € whether the pattern appears to be linear
- € establishing a median regression line to give a line of fit on a scatterplot with a ruler and pencil
- € measuring the gradient of the line of fit drawn, with ruler and pencil
- € noting the vertical intercept of the line of fit drawn
- € establishing the equation of the resulting line of fit in form $y = mx + b$
- € using this equation to make predictions.

The remaining points relate to correlation. Students will not be required to calculate correlation coefficients.

- € interpreting the strength of association using a given correlation coefficient
- € interpreting the sign of a given correlation coefficient
- € recognising that a high degree of correlation does not necessarily imply causality

# Measurement

M5: Further applications of area and volume

- € calculating areas of ellipses, annuluses and parts of a circle (quadrant, sector) using appropriate formulae
- € calculating areas of composite figures
- € applying Simpson's rule over three equally spaced points, ie one application (problems involving five points should be treated using two applications )
- € calculating external surface area of open (without top and/or bottom) and closed cylinders
- € calculating surface area of spheres
- € calculating volumes of composite solids
- € determining errors in calculations resulting from errors in measurement.

M6: Applications of trigonometry

- € solving problems using trigonometric ratios in one or more right-angled triangles
- € using compass bearings (eight points only) and true bearings (three-figure bearings) in problem-solving related to maps and charts
- € establishing the sine, cosine and tangent ratios for obtuse angles from a calculator
- € determining the sign of the above ratios for obtuse angles
- € preparing diagrams to represent given information
- € using the sine rule to find lengths and angles

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

- € calculating area of a triangle using the formula
$$A = \frac{1}{2} ab \sin C$$
- € using the cosine rule to find lengths and angles
$$c^2 = a^2 + b^2 - 2ab \cos C$$
or
$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$
- € using appropriate trigonometric ratios and formulae in two-triangle problems where one triangle is right-angled and the diagram is given
- € solving problems involving non-right-angled triangles
- € selecting and using appropriate trigonometric ratios and formulae to solve problems
- € conducting radial (both plane table and compass) surveys
- € solving problems involving non-right-angled triangle trigonometry, Pythagoras' theorem and area in offset and radial surveys.

M7: Spherical geometry

- € calculating arc lengths of a circle
- € distinguishing between great and small circles
- € using the Equator and the Greenwich Meridian as lines of reference for locations on the Earth's surface
- € locating positions on the globe using latitude and longitude
- € converting nautical miles (M) to kilometres and vice versa, given 1.852 km = 1 M
- € calculating distances between two points on the same great circle in nautical miles and kilometres (radius of the Earth to be taken as 6400 km)
- € defining 1 knot as a speed of 1 M per hour
- € using time zones and the International Date Line in solving problems
- € calculating time differences given the difference in longitudes (Apply 15° = 1 hour and 1°= 4 minutes time difference. Daylight-saving time is to be considered.)
- € determining times for cities in different countries in related travel questions.

# Probability

PB3: Multi-stage events

- € constructing and using a tree diagram to establish the sample space for a simple multi-stage event
- € multiplying the number of choices at each stage to determine the number of outcomes for a multi-stage event
- € establishing that the number of ways in which n different items can be arranged is $n(n-1)(n-2)\ldots\times 1$
- € establishing the number of ordered selections that can be made from a group of different items (small numbers only)
- € establishing the number of unordered selections that can be made from a group of different items (small numbers only)
- € using the formula for the probability of an event to calculate the probability that a particular selection will occur
- € using probability tree diagrams to solve problems involving two-stage events.

PB4: Applications of probability

- € calculating the expected number of times a particular outcome would arise, given the number of trials of a simple experiment, by establishing the theoretical probability and multiplying by the number of trials
- € comparing the above result with an experimental result
- € calculating financial expectation by multiplying each financial outcome by its probability and adding the results together
- € carrying out simulations to model events
- € drawing up a table (two-way table) to illustrate results gained on a test designed to determine the existence (in a particular case) of a phenomenon which has a low overall probability of occurrence
- € interpreting the information in the table and making judgements about the conclusions established by the test.

# Algebraic Modelling

AM3: Algebraic skills and techniques

- € substituting into and evaluating algebraic expressions — linear, quadratic, cubic, as well as those involving square and cube roots
- € adding and subtracting like terms
- € multiplying and dividing algebraic terms and expressions
- € changing the subject of equations and formulae involving linear and quadratic terms
- € solving equations after substituting values
- € solution of equations arising from practical situations by estimation and refinement
- € using positive and negative powers of ten as part of expressing measurements in scientific notation.

AM4: Modelling linear and non-linear relationships

- € generating tables of values and graphing linear functions with pencil and paper
- € interpretation of the point of intersection of the graphs of two linear functions drawn from practical contexts
- € generating tables of values and graphing quadratic functions of the form $y = ax^2 + bx + c,\ x \geq 0$ with pencil and paper

- € noting that different forms of an expression produce identical graphs
- € using a quadratic graph to find maximum and minimum values in practical contexts
- € generating tables of values and graphing cubic, exponential and hyperbolic functions with pencil and paper
- € recognition that, for a > 1, y = b(ax) represents exponential growth and, for 0 < a < 1, it represents exponential decay
- € development of equations such as y = ax2, h = at3 from descriptions of situations in which one quantity varies directly as the power of another
- € development of an equation such as $y = \frac{a}{x}$ from a description of a situation in which one quantity varies inversely with another
- € subsequent evaluation of a in the equations shown in the above two points, given one pair of variables, and using the resulting formula to find other values of the variables
- € using algebraic functions as models of physical phenomena
- € recognising the limitations of models when interpolating and/or extrapolating.

# HSC External Examination Specifications

The written examination in General Mathematics will consist of an examination paper of $2\frac{1}{2}$ hours duration (plus 5 minutes reading time).

Section I (22 marks)

- There will be TWENTY-TWO multiple-choice questions of equal value.
- All questions are compulsory.

Section II (78 marks)

- There will be SIX questions based mainly on the topics prescribed for the HSC course. No more than 30% of the examination will be based on the Preliminary course. Questions based on the Preliminary course can also be asked when they lead in to questions based on the HSC course. Marks from these lead-in questions will not be counted in the 30% Preliminary allowance.
- All questions are compulsory.
- All questions will be worth 13 marks.
- Each question will consist of a number of parts requiring free-response answers.

The formula sheet that accompanies this syllabus will be included with the examination paper.

# DRAFT PERFORMANCE BANDS

*The typical performance in this band:*

| | |
|---|---|
| Band 6 | uses a wide variety of problem-solving strategies to solve mathematics problems<br>successfully applies mathematical skills and processes across a wide range of topic areas<br>communicates mathematical ideas and reasoning clearly and effectively using symbols, numbers, words, diagrams and graphs<br>analyses representations of data and makes predictions, inferences and conclusions<br>constructs and uses diagrams to solve mathematical problems in familiar and unfamiliar contexts<br>makes and justifies informed decisions about financial situations based on appropriate models<br>carries out statistical processes to analyse, interpret and compare data<br>solves problems involving uncertainty using the basic principles of probability |
| Band 5 | uses a variety of problem-solving strategies to solve mathematical problems<br>uses mathematical skills and processes accurately and can apply these in different contexts<br>communicates mathematical ideas and reasoning using symbols, numbers, words, diagrams and graphs<br>analyses data in symbolic, graphical or tabular forms and makes predictions, inferences and conclusions<br>constructs and uses diagrams to solve mathematical problems in familiar contexts<br>makes informed decisions about financial situations based on mathematical models<br>carries out statistical processes to analyse and compare data<br>solves familiar problems involving uncertainty using the basic principles of probability |
| Band 4 | uses some problem-solving strategies to solve familiar mathematical problems<br>uses mathematical skills and processes accurately in familiar contexts<br>communicates mathematics using symbols, numbers, words, diagrams and graphs<br>uses information in graphs, tables or symbols to make predictions, inferences and conclusions<br>draws diagrams and graphs to solve familiar mathematical problems<br>performs calculations in financial mathematics such as substituting into appropriate formulae<br>calculates summary statistics, such as mean and standard deviation<br>performs probability calculations to solve familiar problems |
| Band 3 | uses mathematical skills and processes to solve familiar problems<br>communicates mathematical results using numbers, words, diagrams and graphs<br>uses given diagrams, tables and graphs to make some predictions, inferences and conclusions<br>draws simple diagrams when given clear instructions to help solve familiar mathematical problems<br>performs basic calculations in financial mathematics<br>calculates basic summary statistics, such as mode and range<br>performs simple probability calculations to solve familiar problems |
| Band 2 | uses basic mathematical skills and processes to solve simple familiar problems with limited accuracy<br>communicates mathematical results using numbers, words, simple diagrams and graphs<br>uses given diagrams, tables and graphs to help solve some simple mathematical problems<br>performs some basic calculations in financial mathematics with limited accuracy<br>·ecognises language of probability |
| Band 1 | |